

WHAT IS CLAIMED IS:

1. In an atomic force microscopy (AFM) system including a cantilever with a tip used to analyze a sample, the AFM outputting an AFM data file, a computer readable medium storing computer readable program code for causing a computer to perform the steps of:

- a) receiving user input regarding an analysis to be performed and analysis parameters;
- b) parsing the AFM data file based on the user input to obtain a deflection of the cantilever;
- c) determining an indentation depth of the tip into the sample based at least in part on the deflection;
- d) selecting a model of contact mechanics based on the user input;
- e) solving the selected model of contact mechanics based on the input analysis using the determined indentation depth; and
- f) determining and reducing a residual error.

2. A computer readable medium of claim 1, further comprising computer readable program code for causing a computer to perform the step of displaying results of the analysis to a user.

3. A computer readable medium of claim 1, wherein the analysis parameters comprise at least one of a tip shape, a spring constant, a tip radius, a vertex inclination, and a cone angle.

4. A computer readable medium of claim 1, wherein the determining the indentation depth comprises:

- estimating an initial contact point;
- determining data points of an ideal curve that extends from the estimated initial contact point; and
- determining a difference between the data points comprising the ideal curve and the deflection of the cantilever.

5. A computer readable medium of claim 4, wherein the estimating step comprises:
 - reading data points from the AFM data file in a serial manner;
 - continuously calculating a mean of the data points as the data points are read;
 - continuously calculating a standard deviation for the data points as the data points are read; and
 - finding a first occurrence of a predetermined number of data points that exceed or are exceeded by the current mean by a predetermined number of standard deviations.
6. A computer readable medium of claim 5, further comprising computer readable program code for causing a computer to perform the step of receiving the predetermined number of data points and the predetermined number of standard deviations as user input.
7. A computer readable medium of claim 1, further comprising fitting the indentation depths using a nonlinear algorithm to the selected model of contact mechanics.
8. A computer readable medium of claim 1, wherein the selected model of contact mechanics is one of a Hertz, Bilodeau, and Sneddon model.
9. A computer readable medium of claim 1, wherein determining the residual error comprises determining a difference between the measured indentation depths and indentation depths resulting from the solved model of contact mechanics.
10. A computer readable medium of claim 1, further comprising computer readable program code for causing a computer to perform the step of reducing the residual error.

11. A computer readable medium of claim 10, wherein reducing the residual error comprises:

- selecting at least one new initial contact point;
- repeating c) - f) using the new initial contact point; and
- comparing the residual errors; and
- selecting the initial contact point with the lowest residual error.

12. In an atomic force microscopy (AFM) system including a cantilever with a tip used to analyze a sample, the AFM outputting an AFM data file, a computer readable medium storing computer readable program code for causing a computer to perform the steps of:

- presenting an option GUI to a user;
- receiving test parameters from the user via the GUI;
- reading an AFM data file based on the input test parameters;
- plotting a graph of the deflection of or force on the cantilever versus a position of the cantilever in a second GUI;
- presenting in the second GUI a first user actuated interface for initiating an analysis; and
- performing an elasticity analysis of the data file based on the input parameters in response to actuation of the first user actuated interface.

13. A computer readable medium of claim 12, further comprising computer readable program code for causing a computer to perform the steps of:

- presenting in the second GUI a second user actuated interface for modifying a region of interest function;
- presenting in the second GUI a third user actuated interface for data smoothing function;
- presenting in the second GUI a fourth user actuated interface for a curve rotation function.

14. A computer readable medium of claim 13, further comprising computer readable program code for causing a computer to perform the steps of:

modifying the region of interest in response to actuation of the second user actuated interface;

performing the data smoothing function interest in response to actuation of the third user actuated interface; and

performing the curve rotation function interest in response to actuation of the fourth user actuated interface.

15. A computer readable medium of claim 12, further comprising computer readable program code for causing a computer to perform the step of displaying at least one of a confidence interval graph, a squared error graph, an elasticity graph, and an elasticity/error graph.

16. A computer readable medium of claim 12, further comprising computer readable program code for causing a computer to perform the step of formatting results of the analysis into a text file.

17. A computer readable medium of claim 16, further comprising computer readable program code for causing a computer to perform the step of displaying the text file to the user.

18. A computer readable medium of claim 12, further comprising computer readable program code for causing a computer to perform the step of formatting the results of the analysis into a spreadsheet format.

19. A computer readable medium of claim 18, further comprising computer readable program code for causing a computer to perform the step of associating each parameter and the results of the analysis with a predetermined field.

20. A computer readable medium of claim 18, further comprising computer readable program code for causing a computer to perform the steps of:

creating a thumbnail view of a data curve for the analysis; and
storing the thumbnail view with the results.

21. A system for gathering and analyzing data, comprising:
an atomic force microscopy (AFM) system including a cantilever with a tip used to analyze a sample, the AFM outputting an AFM data file;
a memory for storing the AFM data file and in communication with the AFM;
a computer to read the AFM data file from the memory;
a display coupled to the computer for displaying output from the computer;
input means coupled to the computer to receive user input;
means for parsing the AFM data file based on the user input to obtain a deflection of the cantilever;
means for determining an indentation depth of the tip into the sample based at least in part on the deflection;
means for selecting a model of contact mechanics based on the user input;
and
means for solving the selected model of contact mechanics using the determined indentation depth to obtain a result.
22. The system of claim 21, further comprising means for reducing a residual error in the result.
23. The system of claim 21, further comprising means for formatting results of the analysis into a text file.
24. The system of claim 21, further comprising means for formatting the results of the analysis into a spreadsheet format.
25. The system of claim 21, further comprising:
means for plotting a graph of the deflection of the cantilever versus a position of the cantilever in a second GUI; and
means for presenting in the second GUI a first user actuated interface for initiating an analysis.